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From: Dresser, Chris
Sent: Thur 8/27/2015 3:04:01 PM
Subject: Review of VOC cost effectiveness for various control technologies

In preparation for our upcoming U&O FIP, I took a look at the available control and cost information for regulating the oil and gas sector. The most comprehensive analyses were done by Colorado for their Reg 7, and by EPA for the NSPS OOOO revision and CTGs. As we discussed, the Fort Berthold FIP had an extremely high cost effectiveness due to the very large amount of uncontrolled VOCs being emitted – less than $17/ton. Our FIP for U&O will likely have much higher values. Below is a summary of $/ton of VOC controlled for different equipment from the Colorado Reg 7, OOOO RIA, and CTGs. The values generally assume a threshold of 6 tons per year and 95% control. The list is not comprehensive, but is intended to give a range of cost effectiveness values to inform our U&O FIP.

Note that for other states with O/G regulations, most didn't provide a cost analysis, or in the case of Utah, simply used Colorado's cost analysis. Texas provides estimated costs of reducing VOCs through various controls, but not a $/ton estimate.

Cost Analysis from CO Reg 7

Flares

Condensate Tanks with Flares: **$716/ton**

Produced Water Tanks with Flares: **$715/ton**

Crude oil tanks with Flares: **$427/ton**

First 90 days of controls with Flares: **$77/ton**

Storage Tank Emission Management Plan (STEM)

Buffer Bottle: **$395/ton**

High-low pressure (HLP) separator: **$443/ton**

LDAR (ongoing): **818$/ton**

Auto igniter: **$272/ton**

Replacing high bleed with low bleed pneumatics: N/A

Dehydrator control: **$632/ton**

Overall cost of CO Reg 7 is **$300/ton**

Cost Analysis from OOOO RIA

Oil Well Completions: **$1,100/ton**

Fugitive Emissions: **$1,400/ton**

Pneumatic Pumps: **$560/ton**

Compressors: **$5,600/ton**

Pneumatic Controllers: **$320/ton**

Overall cost of implementing NSPS OOOO nationally is **$1,400/ton** (not counting recovery savings)

Cost Analysis from CTG

VRU: **$1,189/ton to $14,858/ton** depending on number of tanks routed to VRU (not counting recovery savings)

Combustion: **$936/ton to $11,114/ton** depending on number of tanks routed to combustion device

Compressors – Rod Packing Replacement

Gathering and Boosting: **$1,132/ton**

Processing: **$334/ton**

Compressor – Replacing with a Dry Seal Compressor: **$1,931/ton**

Compressor – New Combustion Device: **$6,292/ton**

Compressor – Existing Combustion Device: **$183/ton**

Pneumatic Controller - Replacing high bleed with low bleed pneumatics: **$210/ton**

Pneumatic Pumps – Routing to a New Combustion Device: **$23,944/ton** for diaphragm pump, **$218,017/ton** for piston pump

Pneumatic Pumps – Routing to an Existing Combustion Device: **$312/ton** for diaphragm pump, **$2,840/ton** for piston pump

Pneumatic Pumps – Routing to a New VRU: **$27,094/ton** for diaphragm pump, **$245,860/ton** for piston pump

Pneumatic Pumps – Routing to an Existing VRU: **$312/ton** for diaphragm pump, **$2,840/ton** for piston pump

Leaks – LDAR: **$1,160/ton** to **$20,192/ton** depending on test approach, frequency, and site

*****Also, for our discussion Monday, I think we should begin to answer the following questions necessary to complete a cost analysis.

What sources will be covered under the rulemaking?

What are the average emissions per well? What is our emissions inventory data source?

What control technologies will be required? What are the costs? What is the effectiveness of those control technologies?

What source/control technology scenarios are conceivable? E.g., a facility with one pit-flare, single tip utility flare, enclosed combustor, and two auto-ignition or continuous pilot system devices. What are the costs of those scenarios?

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